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ABSTRACT

One day before a health study appeared in the "New England Journal of Medicine (NEJM)" the study was reported media. A content analysis of the top 5 national newspapers examined the accuracy of this news reporting. The NEJM study found that men who took aspirin had 50% fewer heart attacks than men who received a placebo. Analysis of the original study and the news articles about the study showed that journalists did not present the research methodology correctly, and omitted and sensationalized information from both the formal study and the medical professionals they interviewed. Results also indicated that by incorrectly generalizing the results and by overemphasizing the importance of the study, journalists may have been responsible for encouraging unhealthy or even deadly behaviors. (One table of data is included; 27 references are attached.) (PRA)

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How Accurate Is The Science News We Receive From The Mass Media?

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How Accurate Is The Science News We Receive From The Mass Media?

On Wednesday, January 27, 1988, the mass media reported that a study published in The New England Journal of Medicine found that men who took aspirin had 50 percent less heart attacks than men who received a placebo.

This paper reports a content analysis of the top five national newspapers which found that the public did not receive accurate news information about the aspirin study. By incorrectly generalizing the results and overemphasizing the importance of the study, journalists may have been responsible for encouraging unhealthy or even deadly behaviors. Also found was that journalists omitted and sensationalized information from both the formal study and the medical professionals they interviewed.

The kinds of information journalists include in their science news reports and the factors which influence the accuracy of the science news the public receives is also examined.

How Accurate Is The Science News We Receive From The Mass Media?

On Wednesday, January 28, 1988, The New England Journal of Medicine published a "preliminary report" from the Physicians' Health Study which found that the number of heart attacks was reduced almost in half for men who took aspirin compared to those who received a placebo. One day before the study was formally published, it appeared in the top national newspapers and television news reports. For several reasons, including the study's methodological limitations and because those taking the aspirin suffered more strokes than did the control group, the editor of the Journal and the authors of the formal report did not recommend that the general public start using aspirin as a means of preventing heart attacks.

This paper demonstrates by method of content analysis that the mass media did not accurately communicate the Physicians' Health Study and may have been responsible for promoting unhealthy -- potentially deadly -- behaviors. We will specifically look at the information contained in the news articles from the top five national newspapers.

As a case study, the Physicians' Health Study (also referred to as the "aspirin study" in this paper) allows us to examine the kinds of information journalists include in their reporting of science news, how science information flows from medical professionals to the mass media organizations, the factors which influence the accuracy of science news reporting, and how these communication activities may affect the health of the general public.

Selection of the aspirin study to investigate the diffusion of a science news story was based on the following reasons:

*The aspirin study received a significant amount of attention by the national news media.

*The study was published in one of the major medical journals -- it met the criteria of well conducted and "important" research and provides a archetype from which to determine the accuracy of the newspaper articles.

*Reporting this science news story accurately was extremely important: the potential negative implications of careless journalism may have been quite serious. Providing incorrect information or exaggerating the benefits of an inexpensive nonprescription drug for reducing the chance of heart disease -- known as the nation's number one killer -- could have led to widespread self-treatment. The regular use of aspirin can be quite dangerous to healthy individuals and can cause major medical problems and even death to those with certain medical conditions.

The Physicians' Health Study as reported in <u>The New England Journal of Medicine</u>

Over 22,000 male physicians, between 40 to 84 years of age, participated in the study. The treatment group ingested 325 milligrams of buffered aspirin (one tablet) every other day, while the control group received a placebo. The researchers hypothesized that the aspirin would reduce deaths from heart attack.

The study was initially planned to be conducted for eight years, but after 4.8 years an "independent board" which had been periodically

monitoring the data recommended that the aspirin portion of the study be terminated so that the study's participants could be informed of the preliminary findings (a second purpose of the study was to test the effect of beta carotene on cancer prevention). The independent board also recommended that the results be formally published to prevent "inaccuracies and misinterpretations."

The decision to conclude the aspirin study was based on the following data: The number of physicians who had fatal heart attacks in the aspirin group was five; compared to 18 suffered in the placebo group ($P< 0.00001$). Ninety-nine physicians who took aspirin had nonfatal heart attacks, but 171 suffered nonfatal heart attacks in the control group ($P< 0.00001$). The authors report that they found a 47 percent reduction in the risk of either a fatal or nonfatal heart attack for the aspirin group.

For those physicians taking aspirin there was also a 15 percent increase in the incidents of fatal or nonfatal strokes, although this difference was not found to be significant ($P= 0.41$). There was, however, a significant difference between the aspirin and placebo groups when the data was subdivided by type of stroke and severity. Ten aspirin takers, as opposed to two in the placebo group, suffered either what the authors categorize as a moderate, severe or fatal hemorrhagic stroke ($P= 0.02$). While the authors argue that the causation between taking aspirin and an increase in the risk of stroke cannot be confirmed from such small numbers, they do note that an increase in strokes was found for aspirin takers in another similar study.

Generalizability of the results

As with any research study which collects data from a sample of individuals, the generalizability of the results obtained must be evaluated in terms of the assumptions made about the sampled participants. The

participating physicians were randomized into experimental groups, but how similar they were to the general population is very questionable.

Over 261,000 physicians were initially contacted in 1982 and asked to participate in the study, of these, 59,285 agreed. Over 26,000 were eventually excluded because they had either a history of a heart attack, stroke, transient ischemic attack, cancer, liver or renal disease, gout, peptic ulcer, or contraindications to the use of aspirin. Willing participants were also not eligible if they currently used aspirin or other plateletactive drugs, nonsteroidal antiflammatory agents, or vitamin A supplements.

Prior to the data collection, all the remaining physicians were supplied with aspirin for an eighteen week period. Those physicians who subsequently could not tolerate the aspirin or had changed their minds about participating with the study were excluded. From the original number of physicians who initially expressed an interest in participating, 37,214 (63%) were eventually eliminated due to the study's protocol; 22,071 physicians were eventually randomized into the treatment and control groups. {The physicians were asked to take one of two pills every day: a white pill (aspirin or placebo) on odd days and a red pill (beta carotene or placebo) on even days. It is important to note that the results cited above were derived from all the 22,071 physicians who began the study, even though 4.6 percent stopped taking one of the pills and 12.4 percent stopped taking both pills sometime during the 4.8 years.}

In an editorial published in the same issue of The New England Journal of Medicine as the preliminary report, Arnold Relman admits that the physicians represent a "highly selected population," so different from the general population that "the cardiovascular mortality in (the sample) of physicians was much lower than would be expected in the general U. S. male

population" (Relman, 1988 a, p. 246). How much lower? The authors of the Physicians' Health Study point out that 733 cardiovascular deaths would have been expected in a normal male population, compared to the 88 which did occur in the selected group during the study (The Steering Committee of the Physicians' Health Study, 1988 a).

Putting the results of the study into perspective, Relman states that "The trial results provide good reason to consider using aspirin in patients meeting (the study's) criteria, but they do not demonstrate the value and safety of aspirin in the general population -- particularly in those at risk for hemorrhagic strokes (hemorrhagic strokes occur when a large quantity of blood is discharged from a ruptured blood vessel. Compared to ischemic strokes, hemorrhagic strokes are referred to as being "more deadly") or other hemorrhagic complications of aspirin therapy" (Relman, 1988 a, p. 246). Relman later states that ". . . a final judgement on the general prophylactic use of aspirin in apparently healthy subjects cannot yet be made with any confidence" (Relman, 1988 a, p. 246).

Whereas Relman states that the use of aspirin to prevent heart attacks "cannot yet be made with any confidence," the authors of the Physicians' Health Study interpret the generalizability of the results differently. They do state that "the data from the trial cannot directly address" the question of the generalizability of the findings to those physicians excluded from the study or to the general public, but they are willing to suggest that physicians use aspirin in cases "in which the clear net benefit in preventing (heart attacks) is weighed against the well-recognized hazards of gastrointestinal discomfort and bleeding, as well as the observed risks of hemorrhagic strokes" (The Steering Committee of the Physicians' Health Study, 1988, p. 264). The authors also state that although the findings did not answer the

question of the generalizability of the results, they suggest that "there seems little reason to suspect that the biological effects of aspirin would be materially different in other populations with comparable or higher risks of (heart attacks)" (The Steering Committee of the Physicians' Health Study, 1988, p. 264).

Both Relman and the authors of the formal report discuss a British study (in press at that time, but published three days after the Physicians' Health Study (Peto *et al.*, 1988)) which found that aspirin had no significant effect on preventing heart attacks; and again, there were more strokes for those taking aspirin. In the next section we will look at how the aspirin study was interpreted by the mass media and reported to the public.

Content Analysis of the Top Five National Newspapers

The top five national newspapers all had an average daily circulation of over one million when they reported the aspirin study (The Wall Street Journal, 1,869,950; USA Today, 1,338,734; New York Daily News, 1,281,706; Los Angeles Times, 1,116,334; and The New York Times, 1,038,829 (Editor and Publisher, 1988)).

The aspirin study made the front page of USA Today and The New York Times, and the front page section of the The Wall Street Journal's "What's News," although the complete article appeared on page two. The New York Daily News chose to place the article on page seven and the Los Angeles Times' coverage of the aspirin study was found on page eight.

The headlines and all information contained in the newspaper articles were compared with both the actual aspirin study and the editorial which preceded the study as published in The New England Journal Of Medicine.

Information about the participants

Since the results obtained from the aspirin study can only be generalized to persons similar to the study's participants, knowledge of the participants age, gender and occupation, as well as the criteria they had to meet to be included in the study was necessary to accurately interpret the findings. The first analysis of the newspaper articles looks at what information each newspaper article included when describing the participants and the study's criteria. We will then examine what population each newspaper suggested could benefit from the study's results.

The New York Daily News was the only newspaper not to mention the occupation of the participants, but the top three newspapers failed to state the participants' age. The only description offered in all five articles was the gender of the participants (Table 1).

The New York Daily News, the only newspaper which did not tell its readers both the occupation and age of the participants, offered the most detailed description -- although not complete -- of the criteria the middle-aged male physicians had to meet to participate in the study. The article stated that they had "never suffered heart attacks, strokes or other serious illness" (Daily News Staff Writer, 1988, p. 7). The New York Times did state that the participants were an "extremely low risk group," but no explanation was provided as to why they were considered "low risk."

By explaining the reasons why some of the physicians were excluded from the study, two of the newspapers indirectly described the criteria the participants were required to meet. The article in The New York Times quoted the study's principle investigator as saying that "about half of the physicians eligible for the study were ruled out because they were already taking aspirin" (Schmeck, 1988, p. A17), which is incorrect. "Already

taking aspirin" was one of several reasons why 44% of the initial 59,285 physicians who agreed to participate in the study were eventually excluded. The Los Angeles Times article stated that "After an initial 18 week-study, the researchers excluded 11,152 who did not comply with the daily pill-taking regimen or who reported adverse reactions to either aspirin or beta carotene" (Maugh, 1988, p. 23). This is true, but the more important fact that the researchers had previously excluded 26,026 physicians who had a history of serious illnesses was not discussed in the article. The only description mentioned by The Wall Street Journal and USA Today articles which might have distinguished the participants as possibly different from the general public was that they were "healthy." In fact, four of the articles used the term "healthy" when describing the participants. The Wall Street Journal described them as "healthy men" and "healthy doctors", USA Today called them "healthy male doctors", the Los Angeles Times stated they were "healthy individuals" and "healthy physicians", and the New York Times said they were "healthy people" whose "state of health and health consciousness was generally excellent." Besides the information offered about the participants' occupation, age and gender, the reader's only indication as to how the study's participants might have been different from the general population is that they were healthy. But what is healthy? According to The New York Times it is not taking aspirin, and healthy is not having "adverse reactions" to aspirin as defined by the Los Angeles Times. A definition of what determines one to be healthy was not even offered in the top two national newspapers: The Wall Street Journal and USA Today.

Generalizability of the results

As discussed in the previous section, four of the journalists (all except the Daily News staff writer) condensed their explanation of the criteria the male doctors had to meet to participate in the study by referring to them as "healthy." Four articles also used the term "healthy" when making the assumption that the results of the study could be generalized to their "healthy" readers. In these instances, the journalists used the term in the following context: instead of referring to the participants as "healthy," they suggested that "healthy" individuals could now benefit from newly discovered effects of aspirin on heart attacks. The second sentence of the USA Today article read: "The National Heart, Lung and Blood Institute study is the first to show that aspirin reduces heart attack risk in healthy people" (Friend, 1988, p. 1). Notice the distinction, the journalist is not referring to the participants in the study, but to his readers -- those who are "healthy." The Los Angeles Times article inferred that the findings were applicable to a healthy population by stating: "(the study) was formed at the Harvard Medical School in 1982 to study whether aspirin could prevent heart attacks in healthy individuals . . . " (Maugh, 1988, p. 23).

The front page "What's News" section of The Wall Street Journal read: "The study provides the first indication that aspirin reduces heart-attack risk among healthy men" (Bishop, 1988, p. 1). In this sentence at least The Wall Street Journal narrowed their generalization of the findings to healthy males. The New York Daily News makes the generalization to both healthy men and to those who have healthy hearts. The first sentence in the article states: "Healthy men can cut their risk of heart attacks nearly in half by taking a single aspirin every other day, according to a major new study" (Daily News Staff Writer, 1988, p. 7). In the next paragraph the following

sentence appears: "But the new research is the first to show that aspirin is good for those whose hearts are outwardly healthy."

The New York Times was the only newspaper not to use the term "healthy" when generalizing the results of the study. The New York Times did, however, generalize the results to all males with the lead paragraph:

> A major nationwide study shows that a single aspirin tablet every other day can sharply reduce a man's risk of heart attack and death from heart attack (Schmeck, 1988, p. A1).

Three paragraphs later the article states:

> In recent years smaller studies have demonstrated that a person who has had one heart attack can reduce the risk of a second by taking aspirin, but there had been no proof that the beneficial effect would extend to the general male population (Schmeck, 1988, p. A1).

These paragraphs leave the reader with the impression that all males can benefit from taking aspirin. USA Today also stated that besides benefiting middle-aged healthy men, aspirin could benefit "risk prone men in their 20s" (Friend, 1988, p. 1).

Journalists generalized the results to anyone "healthy," "healthy males," and "all men." Two articles also inferred that the results could be further generalized to females and to anyone, regardless of their health. USA Today quoted the study's principal investigator as saying: "most men and some women could begin taking aspirin regularly under a physician's care" (Friend, 1988, p. 1). In addition to generalizing the results to "healthy men," "risk prone men in their 20s," and "some women" the article in USA Today also suggested that everyone can now benefit from the findings. The headline of the article read: "Aspirin halves *your* risk of heart attack" (emphasis mine) and the lead paragraph read:

> Taking an aspirin every other day cuts the risk of heart attack by nearly half, new research shows (Friend, 1988, p. 1).

The Los Angeles Times also suggested that the results might benefit women by choosing to use the following quote:

> Further, there is virtually no evidence that aspirin would confer a similar protection to women, although "there is no reason to believe women will respond differently," Hutchinson said (Maugh, 1988, p. 23).

The top five national newspaper incorrectly generalized the results of the aspirin study to "healthy individuals," "healthy men," "all males," "most men," "risk prone men in their 20s," "some women" and even to anyone. By not explaining the criteria the participants had to meet to be included in the study, the journalists further promoted the false belief that the results of the study were applicable to those other than the select group which participated in the study. Readers of any of the five articles might have been left with the impression that aspirin could reduce their chance of heart attack by nearly 50 percent. The only explanation of how the participants were different from the general population in that they were healthy. But individuals may have began taking aspirin either because they considered themselves healthy and reasoned that if aspirin worked for healthy people, then it would certainly have the same affect on them, or they may have assumed that if aspirin reduced the chance of heart attack for healthy people, then it would possibly do the same for those who considered themselves unhealthy.

In the preceding section we saw how the manner in which the methodology and results of the aspirin study were presented might have encouraged aspirin use. Three of the newspaper articles did, however, include information may have deterred the treatment for some or

encouraged others to contact a physician before using aspirin to prevent heart attacks.

Recommended Behaviors

The USA Today journalist, for example, wrote, "Aspirin can increase risk of stroke or gastrointestinal problems for some" (Friend, 1988, p. 1). He then went on to quote the study's principal investigator, Dr. Charles H. Hennekens, as saying "most men and some women could begin taking aspirin regularly under a physician's care" (p. 1). This article also quoted Dr. Lawrence Cohen, professor of medicine at Yale School of Medicine, as saying "women with risk factors also should ask their doctors about taking aspirin" (p. 1).

In reference to the potential negative effects of aspirin, the Los Angeles Times article read: "Researchers are concerned about possibility of such widespread use because aspirin has many side effects" (Maugh, 1988, p. 23). The article later gave an indication of one of these side effects by stating, "The remainder of strokes are caused by excessive bleeding, and aspirin would increase their severity" (p. 23). A quote from Dr. Claude Lenfant also warned that "There are a number of people who can benefit from this treatment, but I hope not everyone in the U.S. is going to take aspirin every morning" (p. 23). The following caution also appeared in the Los Angeles Times article:

> Despite the findings, however, physicians Tuesday were not ready to recommend that everyone take aspirin (p. 23).

The Los Angeles Times article indirectly suggested that the public should contact their doctor before taking aspirin with the following quote from Dr. George B. Hutchinson:

> All we can conclude is that it will be necessary for physicians to balance the risk of stroke and heart attack for each patient (p. 23).

In The New York Times article, Dr. Claude Lenfant is quoted as saying:

> . . . the general public should not take the report as an indication that everyone should start taking aspirin. ' "It should be used as a drug, not a panacea" ' he said in answer to a query by telephone (Schmeck, 1988, p. A1 and A17).

With this quote, The New York Times warns that aspirin can be harmful, and the article also -- as did USA Today and the Los Angeles Times -- suggests that the public should consult their physician before taking aspirin by stating:

> (Dr. Lenfant) and other specialists stressed that the decision on using aspirin to prevent heart attack should be made individually by the person and his physician (p. A17)

And later saying:

> The findings of a small excess of strokes was one of the reasons Dr. Hennekens and Dr. Lenfant both said the decision for or against using aspirin to prevent heart attacks should be made case by case" (p. A17).

The Wall Street Journal and the New York Daily News articles did not contain any information regarding the consequences of aspirin use or what behavior the public should conduct given the result of the Physicians' Health Study.

For those who did read one of the three articles which suggested that aspirin might increase the chance of a stroke or gastrointestinal problems, some may have believed that they, or certain segments of the population -- most men, some women, women with risk factors -- should consult a doctor before taking aspirin. For those individuals who did contact a physician, the advice they would have received would have depended on whether their physician read the mass media accounts of the study, the formal report, or the editorial which preceded the study. (Not until six months after the

report was published did The Food and Drug Administration formally comment on the research and whether physicians should recommend that patients use aspirin to prevent heart attacks. This FDA article states that because of the "preliminary nature of the published report, the lack of extensive critical scientific discussion of its findings, and the absence of authoritative professional labeling based on the study, physicians will, for a time, be forced to make their professional judgement about aspirin use on the basis of incomplete findings" (Young, 1988, p. 3158).)

But these warnings may have been unheeded, especially considering the "importance" the newspapers placed on the study. The journalists, for example, used the word "dramatic" or "unexpected" when describing the results, and they stated that the study was "halted ... so that the results could be reported as soon as possible to the participants and to the medical profession in general." (Schmeck, 1988, p. A1) The New York Times reporter states that "the benefits of aspirin stood out with unexpected vividness" and quoted the study's principal investigator as saying, "The magnitude of the beneficial effect was far greater than expected" (Schmeck, 1988, p. A1). According to The New York Times article, Dr. Claude Lenfant from the National Heart Lung and Blood Institute stated that the results were " 'extremely important' " (Schmeck, 1988, p. A1). The New York Times also quoted the Journal and wrote: "the results showed 'a statistically extreme benefit effect' from the use of aspirin" (Schmeck, 1988, p. A1). The Los Angeles Times quoted the "highly respected" editor of the Journal, Arnold Relman, as saying the study is " 'a milestone in the continuing struggle against heart attack" (Maugh, 1988, p. 1).

The following statements were also provided by the journalists to give their readers an indication of the extent of the "importance" of the findings in respect to the number of heart attacks aspirin was predicted to prevent.

The USA Today article read:

> Dr. Lawrence Cohen, professor of medicine at Yale School of Medicine, says "thousands of heart attacks will be prevented" by taking aspirin (Friend, 1988, p. 1).

Dr. Cohen was also quoted in The New York Daily News as saying:

> "There will be many thousands of people whose heart attacks will be prevented by this medical intervention," predicted Dr. Lawrence Cohen of Yale Medical School (Daily News Staff Writer, 1988, p. 1).

The Los Angeles Times science writer made his own prediction with the following statement:

> The finding has broad implications because an estimated 1.5 million Americans suffer first heart attacks each year and a third of them die as a result (Maugh, 1988, p. 23).

The aspirin study investigated the effects of one of the most "popular" drugs which is promoted and used for a variety of illnesses and conditions. Aspirin is also easily accessible and relatively inexpensive. This drug was reported in these article to prevent an illness which is the number one killer in America; a disease feared by many individuals. In fact, three of the articles reminded the public that heart disease is responsible for most deaths in our society with the following statements:

> USA Today: Heart attacks are the USA's No. 1 killer, striking 1.5 million each year, 540,000 fatally.

> New York Daily News: Heart attacks are the nation's leading killer. The American Heart Association estimates that as many as 1.5 million Americans will suffer heart attacks this year, and 540,000 of them will die.

Los Angeles Times: The finding has broad implications because an estimated 1.5 million Americans will suffer first heart attacks each year and a third of them die as a result.

The reader of any of these five articles would have received a different interpretation of the results and consequences of the aspirin study. All five articles, however, did not adequately describe the study's participant, but more importantly, each incorrectly generalized the results to individuals different from those who participated in the study. Each article also over-emphasized the importance of the results.

Three of the five articles did point out some of the potential health risks from taking aspirin, and directly or indirectly suggested contacting a doctor before using aspirin. But considering the availability of aspirin, its reported prevention of the nation's number one killer, and the incorrect generalizations and sensational reporting, readers of these articles may have disregarded the warnings. For those who did contact their doctors, a recommendation would have depended on where the doctors received information about the study [1]. Those who read The Wall Street Journal or the New York Daily News found only information which promoted the belief that aspirin use on a regular basis would prevent a heart attack.

The manner in which the newspapers interpreted and reported the aspirin study would have given the reader an incorrect impression of the study's methodology, and more importantly, the generalizability of the results. Not describing the complete criteria that the physicians had to meet to be included in the study influenced how the public judged if the reported effects of aspirin was applicable to them, for example. Similarly, including the statistics on the number of people who die from heart disease

and calling the results "dramatic" increased the probability that the public would start using aspirin for heart attack prevention.

These findings are in agreement with past studies which have investigated the accuracy of science news reporting by the mass media (O'Keefe, 1970; Pulford, 1976; Moore and Singletary, 1985; Tankard and Ryan, 1974; Tichenor *et al.*,1970). In these studies, scientists were asked to evaluate newspaper articles or television broadcasts about their work. The degree to which the mass media accurately reports science information was therefore determined by the source of that information in these studies. They consistently found that the kinds of errors committed by journalists can be categorized into what Berry (1967) described as subjective errors; that is, sensationalizing information and/or omitting certain information. Also found was that the scientists' overall complaint with science reporting was that journalists sensationalized certain aspects of a study while they neglected other important information. This has also been found when the mass media has reported specific science issues, including herpes (Glover, 1984; Mirotznik and Mosellie, 1986), cancer (Freimuth *et al.*,1984), the effect of TV violence on children (Hirsch, 1981; Pool *et al.*, 1972). and more recently AIDS (Bazell, 1990).

In the next section we will look at other specific kinds of information the journalists decided to include or omit in their aspirin study articles and the effect these decisions had on the accuracy of reporting the study.

What Kinds of Information did the Journalists Include in Their Reporting of the Aspirin Study?

Four days before the aspirin study was formally published, 250 copies of the January 28th, 1988, edition of The New England Journal of Medicine

were given to "representatives of the media." The journalists subsequently had at least 48 hours to prepare and write their report [2]. Even with a complete copy of the formal preliminary report, four of the journalists relied extensively on medical professionals to either describe the "importance" of the study, or to interpret the results (i.e. what the public should do or not do given the findings).

By placing quotes from various professionals throughout the articles, however, the journalists often reported contradictory information. The New York Times, for example, suggests in the following sentence that the reader and the physician should together decide on the aspirin treatment:

> (Dr. Lenfant) and other specialists stressed that the decision on using aspirin to prevent heart attack should be made individually by the person and his physician (Schmeck, 1988, p. A17)

But by including the following quote from the actual study, The New York Times may have led the public (not the physician for who the statement was intended) to believe that the decision to take aspirin to prevent heart attacks should be made individually by those who are convinced of the reported benefit:

> the decision to prescribe aspirin for the primary prevention of (heart attacks) must remain a matter of individual judgement (Schmeck, 1988, p. A17).

The medical professional often contradicted each other and the information which appeared in The New England Journal of Medicine. The USA Today article, for example, quotes Dr. Charles H Hennekens of Harvard Medical School and Brigham and Women's Hospital as saying that "most men and some women could begin taking aspirin . . . " (Friend, 1988, p. 1). Later in the article, the professor of medicine at Yale Medical School of Medicine, Dr. Lawrence Cohen states that besides benefiting "most healthy middle-

aged men" aspirin could benefit "risk prone men in their 20s." What are "risk prone men?" According to the article, those with "a family history of heart disease, high cholesterol levels, diabetes and hypertension ... lack of exercise and smoking" (Friend, 1988, p. 1). Readers the USA Today article would be left with the confusing and incorrect impression that aspirin can prevent heart attacks not only for most men -- including healthy older men, but also for unhealthy younger men and some women.

The journalists were very uncritical in their reporting of the aspirin study. They preferred to use quoted material rather than objectively report the study even when the quotes contradicted the information in the Journal or what other medical professionals stated. This was also found by Shepherd (1981) who after looking at 275 science news articles discussing the effects of smoking marijuana, stated that "the press tends to print the views and interpretations of individual authorities rather than report the results of actual studies" (p. 211).

This brings us to the question of whether the medical professions were correctly quoted. I contacted four of these five medical professionals and asked them this question (The Los Angeles Times article quoted Dr. George B. Hutchinson as a cardiologist at Harvard Medical School four times. After several phone calls, I was repeatedly told by various departments within the school that a Dr. Hutchinson has never been affiliated with Harvard Medical School.)

Dr. Claude Lenfant from the National Heart Lung and Blood Institute and Dr. Lawrence Cohen, professor of medicine at Yale School of Medicine, both indicated that to the best of their recollection, the quotes and paraphrases of their comments were generally accurate.

On the other hand, Dr. Charles H. Hennekens called one of the paragraphs in which he was cited "skewed." He also called the headline "Aspirin halves your risk of heart attack" from the USA Today article "misleading, as it suggests that the same effect (of aspirin for those who participated in the study) might be expected generally among readers of the newspaper article -- e.g., 20 years olds, 30 year olds, 90 year olds; men and women, etc." He also stated that "Such a conclusion is certainly not supported by the evidence available to date."

Dr. Hennekens also stated that the citation, "half of the physicians willing to enroll and otherwise eligible for the study were ruled out because they were already taking aspirin" should have included the underlined statement, which was omitted from the USA Today article.

This was also the case with his following quote:

> The inconclusive finding of a small excess of strokes was one of the reasons Dr. Hennekens and Dr. Lenfant both said the decision for or against using aspirin to prevent heart attack should be made case by case

The Los Angeles Times was the only newspaper to quote the editor of the Journal as saying that aspirin study is "a milestone in the continuing struggle" against heart attack" (Maugh, 1988, p. 23). What Relman states prior to this statement, however, did not make the Los Angeles Times copy: "If (the study's) highly promising preliminary results withstand the test of subsequent full reporting and further peer review, the Physicians' Health Study will be regarded as a milestone . . ." (Relman, 1988 a, p. 246). When I asked Dr. Relman if he believed this quote was taken out of context, he stated "Yes, obviously."

None of the articles mentioned the British study, discussed in Relman's editorial and the Journal report, which found results to the

contrary of the Physicians' Health Study. Interestingly, three of the articles, refer to other studies conducted in the past that found that taking aspirin following a heart attack reduced participants chance of a second attack (Table 1).

Those quotes which the medical professional stated were inaccurate were modified to sensationalize the aspirin study. We can conclude that the journalists omitted and sensationalized sections of both the actual study and the quotes from medical professionals. We will now examine what variables influence the accuracy of science news reporting in general and how these factors affected the reporting of the aspirin study.

The Factors which Influence the Accuracy of Science News Reporting

Tichenor, Olien, Harrison and Donohue (1970) argued that the systems perspective is helpful in understanding science news diffusion as it conceives of a message "as an outcome, or product, of the process, and the system is conceptualized as existing for the purpose or producing such messages" (p. 673-674). By looking at the system in which scientist and journalist operate, we can get a better understanding of the reasons why each may produce different kinds of information about the same subject matter.

Scientists and journalists differ on the degree to which they have control over the information they produce. Scientists select phenomena for study which correspond to the discipline from which they have chosen to receive an education. They collect data, make interpretations and analyses, and write their own research reports. Journalists, on the other hand, do not always have the freedom to report on those studies which they choose. The assignment editor may indicate which stories the journalist must cover,

for example. Journalists consequently report on a variety of different scientific information, some of which they may have little experience, interest or understanding. The reporter also obtains the science information indirectly from secondary sources: the scientist, public information personnel, the research report, the news wire, or the press release. The headlines which appear over their article may also be written by someone else. Control over information, therefore, may be a factor which influences the science information the public receives from the mass media.

The scientist's channel of communication (e.g., convention paper, journal article) does not restrict communication to the degree that the newspaper article or TV or radio news report does. That is to say that the nature of scientific reporting requires the inclusion of certain kinds of information - explanation of previous research and theories, description of the methodology used to collect the data, analysis of data, limitations of the study, and recommendations for future research. Journalists' channels of communication are much more limiting. They must work around time or space constraints; not all scientific information available can be included in their report. Journalists must therefore summarize scientific information and include only those elements of the scientist's work which they determine are important. This is one factor which influenced the reporting of the aspirin study. In general, the longer newspaper articles contained more of the kinds of information necessary to accuracy interpret the study. Certainly, however, what information the journalists decides to emphasize or omit affects the accurately of their report, as was found in this study.

The time necessary for the scientist to prepare a formal report of his or her results may take several weeks or months. The journalist must perform this tasks in a much shorter period of time and under the stress of

deadlines. The fear that a competitor may release the scientific news first puts increased pressure on journalists to complete their report and communicate it to the public as quickly as possible. The time necessary to confirm figures and interpretations may also not be available.

In his editorial, Relman states that giving the press copies of the Journal three days prior to the official publication date is policy by his and other scientific and medical journals (Relman, 1988 b). Relman defends this practice, which he refers to as an "embargo arrangement," because it benefits both the reporters, the Journal, and the public. The three day holding period, according to Relman, ensures that all reporters have equal access to any medical information and sufficient time to analyze, interpret and rewrite any study for the general public without the worry of being the last to "break" the story. The embargo also allows the results to be released by the media concurrent with the Journal's official publication date. Journalists therefore have some time period in which to write their science news reports, but as was the case with the aspirin study, competition between media organizations still affected what information was reported and when it was released.

The story was released prior to the time which had been agreed upon by the Journal and the media: Wednesday, January 27, 1988, at 6 p.m. The Reuters wire service was the first news agency to release the story on Tuesday, breaking the agreed-upon time by 24 hours. On Tuesday evening and Wednesday morning, the major media agencies reacted, broke the agreement, and released the story. Television advertisers, which obviously had been planning in advance with the intent of exploiting the study, ran commercials before the Wednesday, 6 p.m. time (Relman, 1988 b, p. 919). (The story was not reported on the network newscasts until that evening,

which was technically after the 6 p.m. embargo time. Bristol-Myers Product, the makers of Bufferin, supplied the aspirin for the study. The ABC, CBS, and NBC evening newscasts each ran two Bufferin Aspirin commercials the night of January 27th (Abstracts, 1988, pp. 168, 171, 174).

What scientific information ultimately is to be published is evaluated on a different set of criteria by the gatekeepers in the scientific community and the mass media. Johnson (1963) found that editors of newspapers place greater emphasis on sensationalizing science studies than do scientist and readers. While scientist, readers, and nonreaders of newspaper science evaluated science stories primarily on the criteria of accuracy and significance, newspaper editors judged science news stories on "color and excitement." The mass media are motivated by those factors which will sell their product. What scientific information the public is more likely to receive, as a result, is that which is interesting and entertaining, even at the expense of accuracy.

When the public receives scientific medical and health from the mass media, they are relying on a secondary source, the journalist, to interpret and synthesize scientific information. The journalist, unlike the medical and health professional, is neither educated in the specific scientific subject matter nor in the process by which knowledge is acquired. Not only has the scientific information the public (and medical and health professionals) receive from the mass media been misinterpreted, past studies have found that the overall importance of science information has been exaggerated, elements of the study which are not considered to be of importance to the scientist have been emphasized, and the research study was taken out of context from the overall findings in a particular area. This study also

replicates the results of other research which found that journalists omitted portions of the scientific study while sensationalizing others areas.

One manner in which science reporting by the mass media could improve is to have the scientist review the journalist's article prior to its release. Ryan (1979) however found that journalists do not want to change the manner in which they control science news stories. He found that journalists "strongly disagreed with the idea that it would be a good general policy for (journalists) to have their stories read by the scientist quoted in the articles before publication, that headlines for science articles should be written by the reporter who write the stories, that a (journalists) should rely completely on a scientist to point out the most important contribution of the scientist's research, that a scientist should release scientific research results to the press only after the information has appeared in a scientific journal or scholarly publication and that a (journalists) should not interpret a scientists' technical conclusions" (p. 26).

It therefore seems likely that the information the public receives from the mass media will continue to be not as accurate as the information communicated by the scientist, even when the health of the public is at risk.

Table 1

Information found in aspirin articles from top five national newspapers

	Information	Wall Str J	USA Today	Daily News	LA Times	NY Times
1	Occupation of participants	YES	YES	NO	YES	YES
2	Age of participants	NO	NO	NO	YES	YES
3	Gender of participants	YES	YES	YES	YES	YES
4	Study prematurely ended	YES	YES	NO	YES	YES
5	Date of publication	YES	NO	YES	YES	YES
6	Number of participants in study	YES	NO	NO	YES	YES
7	Number of fatal and nonfatal heart attacks	YES	NO	NO	YES	YES
8	Number of strokes	YES	NO	NO	YES	YES
9	Brand of aspirin used	YES	NO	NO	YES	YES
10	Explanation of how aspirin may have prevented heart attacks	YES	YES	NO	YES	YES
11	Mention of any consequence from aspirin use	NO	YES	NO	YES	YES
12	Mention of past studies which found that aspirin might reduce risk of second heart attack	YES	NO	NO	YES	YES
13	Decision to use aspirin should be made by person and physicians	NO	Only women	NO	NO	YES
14	Warning against using aspirin	NO	NO	NO	YES	YES
15	Mention of British study which found no effect	NO	NO	NO	NO	NO
	Totals	**10**	**6**	**2**	**13**	**14**

Notes

1 Research investigating how often doctors rely on the mass media for medical and health information is more than 20 years old. Shaw and Van Nevel (1967) found that 60 percent of the medical faculty surveyed indicated that they sometimes obtained research information "within their own specialties" from the mass media. O'Keefe (1970) found that only 21 percent of medical faculty and non-faculty doctors relied on the mass media once or twice a month for science information within their field, and 24 percent said that science information in the media was important to them.

2 The story was released by the newspapers one day before it was formally published in the Journal.

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